

PUBLIC SCHOOL HEALTH BULLETIN

NUMBER 2

GROUND-ITCH  
OR  
HOOKWORM DISEASE  
AND  
SOIL POLLUTION



ISSUED FROM OFFICE OF  
SUPERINTENDENT OF PUBLIC INSTRUCTION OF NORTH CAROLINA  
RALEIGH, 1910

**Notice to Pupils:** Take this circular home and read it to your parents.

**Notice to the Public:** Copies of this circular may be obtained free upon application to the State Superintendent of Public Instruction, Raleigh, N. C.

**Notice to the Scientific and Medical Professions:** The illustrations used in this circular are taken from a U. S. Government publication, now in manuscript, in which full professional details regarding the same are given.

## TO SCHOOL TEACHERS.

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If an epidemic disease, such as yellow fever, cholera, or bubonic plague, is introduced into a neighborhood, great public excitement results. The epidemic is something unusual and it becomes the topic of general discussion. Because of the unusual disease, and the exceptional number of deaths in a comparatively short time, the community is frequently led to adopt measures that are not only unscientific and unnecessary, but they are in some cases inhumane, and they not infrequently cause, to the city or State, losses in trade, money, and property. While the epidemic is still fresh in the memory of families whose homes have been invaded by it, there is considerable watchfulness against a possible return of the dread disease. As time goes on, the memory of the excitement, anxiety, and distress diminishes, and too often a self-satisfaction and false sense of security lead the people to be contented with conditions which would not be tolerated immediately following the epidemic.

Has it ever occurred to you that the great loss of human life in this country is at present due, not to extensive epidemics, but to preventable diseases that are constantly with us? And not only to *preventable* diseases, but to *easily preventable* diseases? For instance, has it ever occurred to you that in our country more people die in one year from tuberculosis (consumption) than have died in 114 years from yellow fever? Has it ever occurred to you that thousands of lives are needlessly sacrificed in this country every year simply because the general public is either ignorant of certain elementary principles of public hygiene or careless about these principles? Think of the fact that over 35,000 Americans die every year of typhoid fever—a preventable disease due to carelessness and filth!

It is you upon whom the country depends for training the young. The mind of the adult is largely dependent upon the training during childhood. If the child is taught that certain habits will result in sickness, and even in death, he will carry that lesson into his adult life, and when he has a voice in the government of the city or the State he will recall that lesson



and insist upon laws which will stop certain objectionable customs to which, because of a lack of appreciation of the danger involved, the average adult of to-day too frequently does not give a second thought.

Will you as school teachers join in a movement to reduce the unnecessarily high death-rate among innocent thousands—a death-rate due in some cases to ignorance, in other cases to carelessness?

In considering this proposition, your attention is invited, not only to the importance of the subject, but also to the fact *that it involves work*. Short-lived enthusiasm will accomplish only short-lived good. The undertaking calls for earnest, continued, serious work, year after year. The reward for that work is not an increase in pay, but a knowledge of the important fact that **YOU WILL SAVE HUMAN LIFE**. You will save human life just as surely as does the man who plunges into a stream to rescue a drowning child.

Some of the teaching will involve a discussion of subjects not ordinarily mentioned in the school-room containing both boys and girls. *But human life is at stake, and in preparing this circular we must state facts in plain English; there is no escape from this method.* When delicate and unusual subjects are discussed, it is suggested that you divide the classes, boys in one class and girls in another. This can easily be done in schools with more than one teacher. If the facts stated are of such a nature that a woman feels a hesitancy in teaching them to boys, or a man feels a hesitancy in teaching them to girls, it would be well to call upon your local physicians, clergymen, or trained nurses to help you. You will have little or no difficulty in obtaining aid from your local physicians. That the clergymen in your neighborhood will aid you when requested is also a self-understood fact. Doubtless the trained nurses will be glad to help you in this work with the girls.

## SOIL POLLUTION AS CAUSE OF GROUND-ITCH, HOOKWORM DISEASE (GROUND-ITCH ANEMIA), AND DIRT-EATING.

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All children should learn these four rules for preventing disease, namely:

RULE 1. *Do not spit on the floor, for to do so may spread disease.* Both "consumption" and diphtheria are spread in this way.

RULE 2. *Protect against mosquitoes.* Mosquitoes spread malaria ("chills and fever," or "ague"), yellow fever, dengue fever (also known as "break-bone fever"), and elephant foot.<sup>1</sup>

RULE 3. *Do not pollute the soil.* Hookworm disease is spread only by soil pollution. Typhoid, dysentery, and other intestinal diseases are usually spread by soil pollution.

RULE 4. *Protect against flies.* These carry filth and germs to the food, and thus spread typhoid fever. They may spread other diseases, also, such as consumption, inflammation of the eyes, etc. Flies are filthy creatures and should be kept out of the house.

There are many other important points in protecting against disease, but these four rules are of greatest importance, especially for the Southern States.

### Question 1. What is "soil pollution"?

"Soil pollution" is the act of defiling the soil or rendering it unclean; it also refers to the condition of the soil caused by defiling it. The word "*pollution*" means about the same as the words "defilement," "uncleanness," and "impurity." Polluted soil, therefore, is soil or ground which has been defiled, or made impure or unclean, or contaminated.

Usually, when we speak of "soil pollution," we mean that the ground has been made unclean by placing upon it decaying or rotting material or germs which cause disease.

### Question 2. What are the common methods of polluting the soil?

Suppose that a person has consumption, and that, instead of spitting into a cuspidor or spittoon, he spits on the ground; his spit or expectoration contains little germs, which are so small that they cannot be seen by the naked eye. These little

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<sup>1</sup>Elephant foot or elephantiasis is a disease in which the foot or leg swells up so as to be much larger than it should be; it is found in warm (or tropical) climates.



germs are scattered on the ground, and, of course, they render the soil impure, and are likely to spread consumption to healthy people. It is chiefly because of this danger of spreading consumption that we see so many signs with the words "*Do not spit on the floor.*"

Or, suppose that a person has some disease of the kidneys or of the bladder, and that, instead of passing his water into a privy, he passes it onto the ground or into a brook; he pollutes or contaminates the ground or brook with the germs which cause his disease, and thus he may spread his sickness to other people.

Or, suppose that a person has disease germs in his bowels, and that, instead of going to a privy or a water-closet, he goes into a field or the woods and stools there; he pollutes the soil, and may thus spread his sickness to other people.

In to-day's lesson we are to study this last method of soil pollution.

**Question 3. Does the Bible warn against soil pollution?**

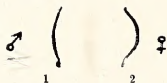
Yes; see Deuteronomy xxiii: 12 and 13:

"12. Thou shalt have a place also without the camp, whither thou shalt go forth abroad;

"13. And thou shalt have a paddle upon thy weapon; and it shall be, when thou wilt ease thyself abroad, thou shalt dig therewith, and shalt turn back and cover that which cometh from thee."

**Question 4. What is hookworm disease?**

Many people, especially in warm climates, have in their bowels a small worm (see Figs. 1, 2) about half an inch long and about as thick as a small hairpin. If a person has many of these worms he becomes weak and sick, and his sickness is called "hookworm disease."



**Figure 1.** A male hookworm, natural size. For enlarged picture see Fig. 9.

**Figure 2.** A female hookworm, natural size. For enlarged picture see Fig. 10.

**Question 5. How is hookworm disease spread?**

A person who has hookworm disease spreads it by polluting the soil. The worms cannot multiply in the bowels, but they lay hundreds of minute eggs (see Fig. 3), and, when the person stools, these eggs are passed in the discharges.

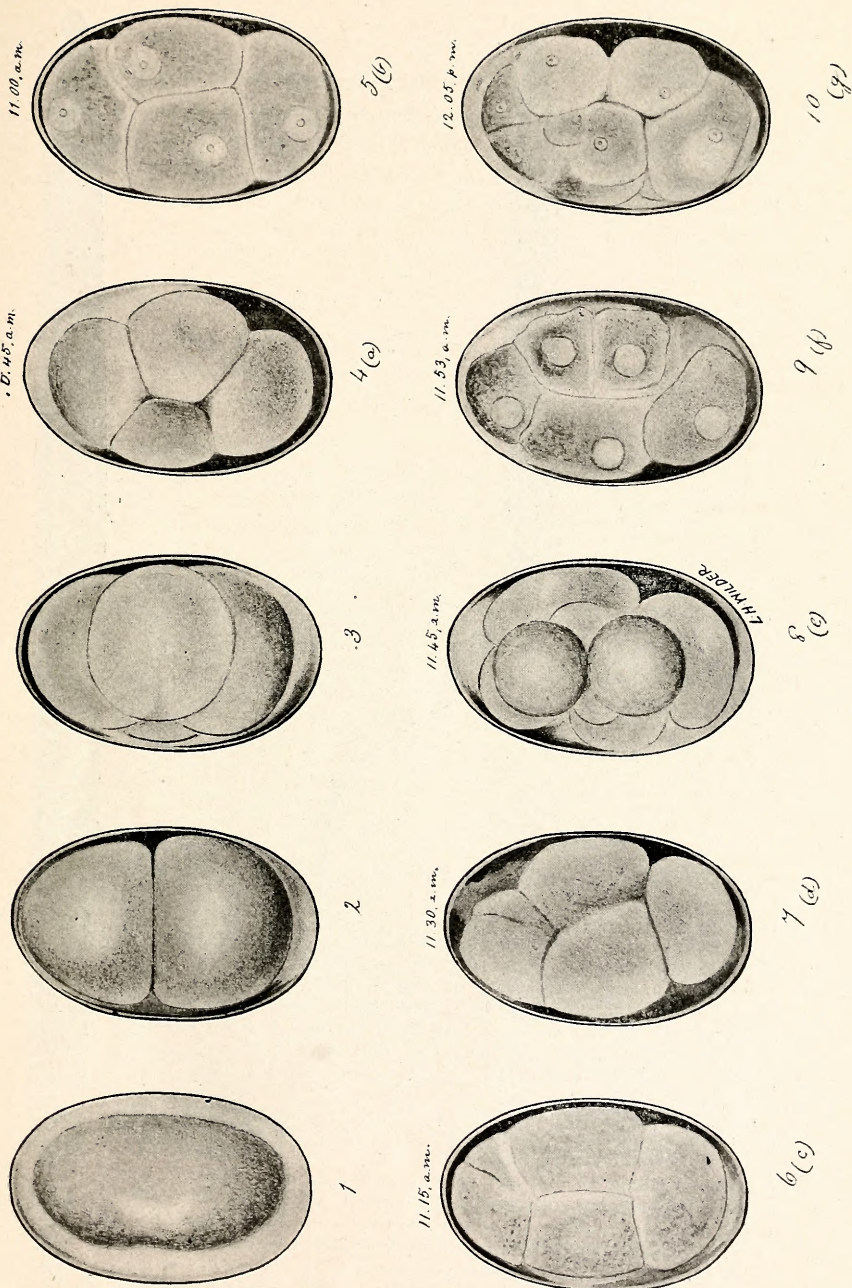


Figure 3. A hookworm egg in process of development. At first this egg contains only 1 cell (see 1), which later divides into 2 cells (2), each of which divides, thus forming 4 cells (3, 4, 5); these cells keep on dividing until, sometimes by the end of 8 hours, a young worm (see Fig. 4) is formed.



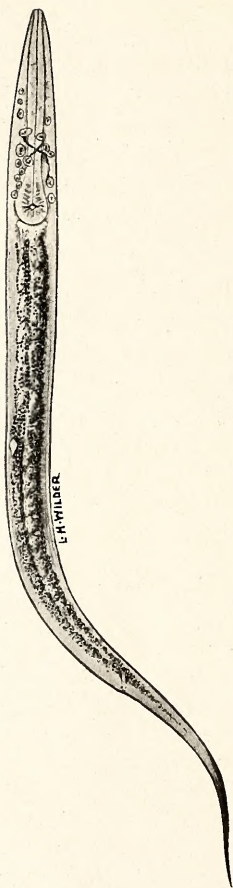


Figure 4. This shows the young worm a short time after it escapes from the eggshell. The bottle-shaped structure at the blunt end is the esophagus, or gullet, and the darker organ following this is the intestine. This worm crawls or is scattered around on the ground. It feeds for about 8 days or more, according to conditions, storing up food and growing; during this process it sheds its skin twice, much like a snake.

Figure 5. This represents the worm after it has shed its skin the second time; the worm remains encysted, as shown, in this skin; it now no longer takes food until it enters man. It may live just so long (5 months, more or less) as it can live on the food which it has already eaten. If it becomes completely dried, it dies; therefore it cannot be blown around in the air as dust; prolonged solid freezing kills it. When partially dry, it is quiet, but it is very active when wet, as in dew. It can wriggle up a surface which is moist. This young worm may be swallowed, but more generally it enters through the skin. (See Fig. 6.)





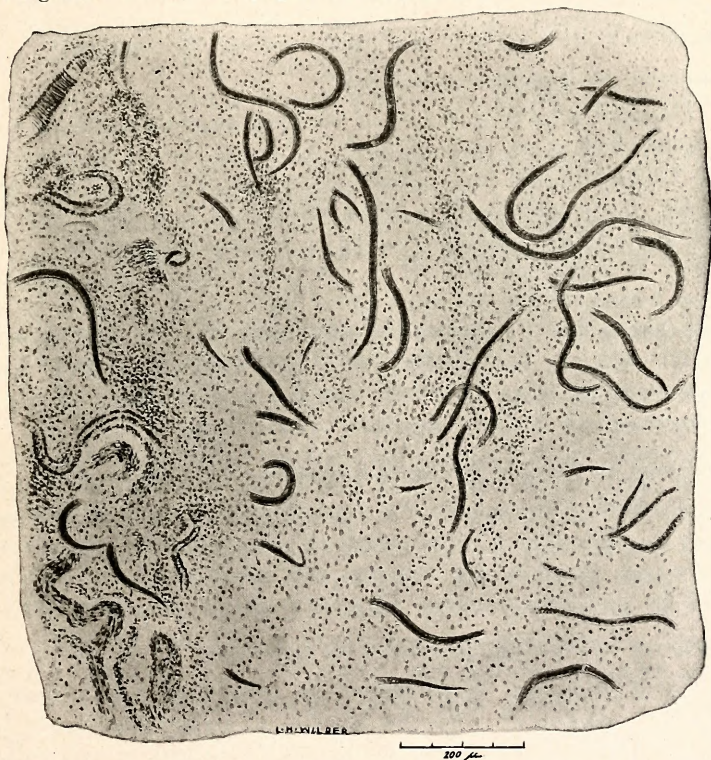
**Question 6. What happens to the eggs?**

In about a day, if the weather is warm, a very tiny worm (see Fig. 4) hatches out of each one of these eggs; this worm feeds for about a week; then it stops feeding and waits (Fig. 5) for a chance to enter some person. It is very active when moist, but very quiet when dry; if it becomes completely dry it dies.

**Question 7. How does this worm enter people?**

The young worm enters the body in two ways:

a. If there is a heavy dew, or if it rains, or if the worm is living in a moist, shady place, the young worm is very active;



**Figure 6.** This shows a slice of skin as seen under the microscope. Notice how the young hookworms are crawling through the skin. This is the way "ground-itch" or "dew-itch" looks. (Next, see Fig. 7.)

when a person walks barefooted over the ground which is polluted by the presence of this young worm, the hookworm crawls into the skin (see Fig. 6). Or,

b. The young worms may be swallowed, either in drinking water or with some salad or other food upon which they have crawled.

**Question 8. If the worm enters the skin, what does it cause?**

When this young worm enters the skin it causes "ground-itch," also known as "toe-itch," "foot-itch," "cow-itch," "dew-itch," or "dew-poison." Thus "ground-itch" results from soil pollution, and is the beginning of hookworm disease. On this account hookworm disease may be called "ground-itch anemia," which means that a person is pale and has pale, watery blood, caused by the hookworms which entered his skin.

**Question 9. How many of this class have had "ground-itch"?**

**Question 10. Describe "ground-itch."**

"Ground-itch" is a disease of the skin caused by coming into contact with moist, polluted soil. It usually occurs on the feet, on which account it is sometimes called "foot-itch," or "toe-itch." It is very likely to occur when there is a heavy dew on the ground, and on this account it is frequently called "dew-itch," or "dew-poison." It is not caused by the dew, but by tiny worms, which are very active when moist, as when there is a heavy dew. These tiny worms enter the skin and cause a small swelling; this swelling may form into an irregular line resembling a vine. The foot itches and this itching makes a person scratch his toes and feet.

**Question 11. Of what disease is ground-itch the beginning?**

Ground-itch is usually the beginning of hookworm disease. If a boy has only a slight attack of ground-itch he may not be very sick, but if he has frequent and severe attacks of ground-itch he may grow pale and weak, and may become quite sick.

**Question 12. How can ground-itch be prevented?**

Ground-itch can be prevented by preventing soil pollution from the discharge from the bowels. Good privies should be built; people should be taught about the danger of soil pollution and the sickness due to it; they should be taught that they must stool in privies instead of on the ground; and they should be taught to clean the privies.

Ground-itch can usually be prevented by wearing shoes, but the most important thing is to prevent soil pollution.



**Question 13.** In what part of the world does ground-itch occur?

Ground-itch occurs in warm climates. Thus, in the United States, it is common south of the Potomac River.

**Question 14.** At what age is ground-itch most common?

Ground-itch is more common in children than in adults.

**Question 15.** Why is ground-itch more common in children?

Because children go barefooted more than adults.

**Question 16.** Does ground-itch occur in all parts of the South?

Ground-itch is more common in the country districts than in the cities, and it is more common in sandy districts than in clay districts.

**Question 17.** Is ground-itch the early stage of any disease other than hookworm disease?

Perhaps some cases of ground-itch develop into a peculiar disease known as Cochin-China diarrhea.

Some cases of ground-itch appear not to be followed by either hookworm disease or by Cochin-China diarrhea; these cases are not yet understood.

**Question 18.** Why is ground-itch more common in the country districts, as on farms, than in the cities?

Ground-itch is more common in the country districts than in the cities because there is less care taken in the country to prevent soil pollution than there is in the cities. In large cities the city government places long pipes under the ground; from these large pipes smaller pipes run into the houses, and water-closets are built in the houses and connected with these smaller pipes. All of these pipes together form what is called the "sewer system," and the discharges from the body are carried far away from the houses, so that the ground around the houses is not polluted. In smaller cities and towns the houses have privies in the back yards, and, when these privies are properly built, and cleaned regularly every week, as they should be, the soil does not become polluted. But on the farms and in the very small towns people are not so careful to prevent soil pollution, so that ground-itch is more common. Only about 60 per cent (or 6 out of 10) of 581 farm-houses, recently examined in 5 Southern States, had privies; on account of this lack of privies, ground-itch is very common on the farm.

Question 19. Why are there so few privies on the farms?

Because it has only recently been discovered that ground-itch is the beginning of hookworm disease, and that this disease is

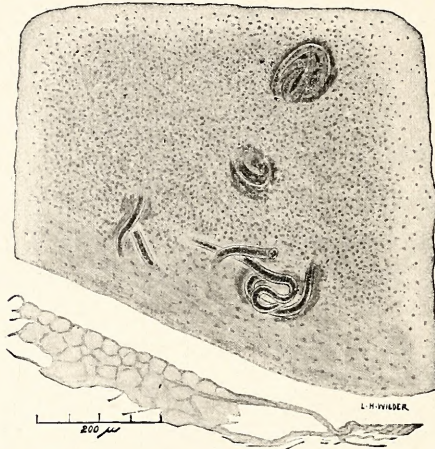


Figure 7. This shows some young hookworms in an organ of the arm-pit (axillary gland). (Next, see Fig. 8.)



Figure 8. This shows a young hookworm in the blood in the heart. (Next, see Fig. 11.)

common in our country, and when our fathers and mothers went to school they were not taught how dangerous it is to pollute the soil.



**Question 20. How does ground-itch turn into hookworm disease?**

The young worms crawl from the skin into the blood (Figs. 7 to 11), and from the blood they finally reach the bowels (Fig. 18); they form a poison which injures the body, and they suck the blood. In this way they make people weak and sick.

**Question 21. How does a person look when he has hookworm disease?**

A person with hookworm disease may have very dry hair and dry, tallow-like skin; he is pale; often he has sores or ulcers on his shins; his abdomen (belly) or his legs may be swollen. When children have the disease they are likely to be stunted in their growth.

**Question 22. How does a person feel when he has hookworm disease?**

A person with hookworm disease usually says he has headaches, dizziness, buzzing in the ears, palpitation of the heart, and soreness in the pit of the stomach when you press on it; he may be very weak, and not able to work hard, walk far, or study much; he gets tired easily; sometimes he complains that it is hard for him to breathe; usually he does not sweat much.

**Question 23. Does hookworm disease make it harder to study?**

Yes. Although some pupils with hookworm disease are able to learn their lessons and to stand well in school, many others are too sick to study, and they fail in their examinations and become "repeaters."<sup>1</sup>

**Question 24. Can hookworm disease be cured?**

Yes. There are only a few diseases which can be cured so easily as hookworm disease.

**Question 25. If a person has had ground-itch and is pale, what should he do?**

He should ask his father or mother to take him to the family doctor (physician), and should ask the doctor whether he has hookworms.

<sup>1</sup>A "repeater" is a pupil who spends more than one year in a grade; he "repeats" his work for the year.

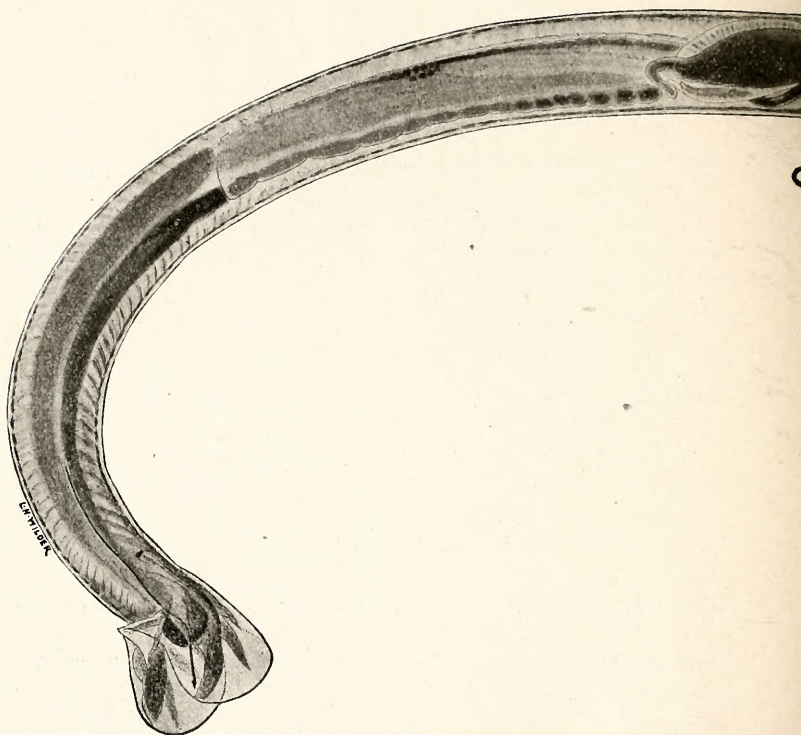


Figure 9. A male hookworm (known as the American Murderer—b  
a microscope. See how its head is turned back

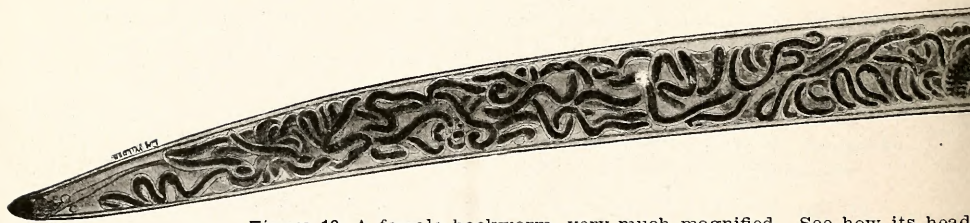
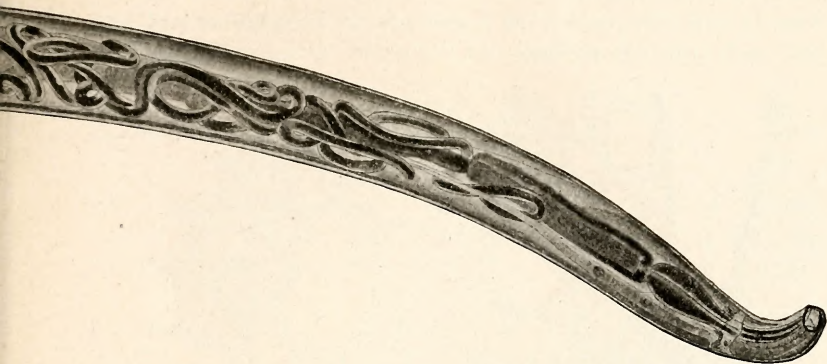
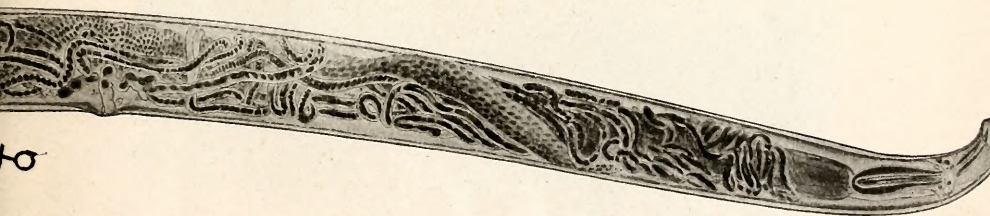


Figure 10. A female hookworm, very much magnified. See how its head





s so many people), very much magnified under an instrument known as  
 how its tail is broadened into an umbrella-like organ.



ckward and how its body is filled with organs containing hundreds of eggs.

Question 26. Can a doctor tell whether a person has hookworms simply by looking at him?

Yes, in case the person has a great many hookworms and is clearly sick from the disease. If the person is not sick enough

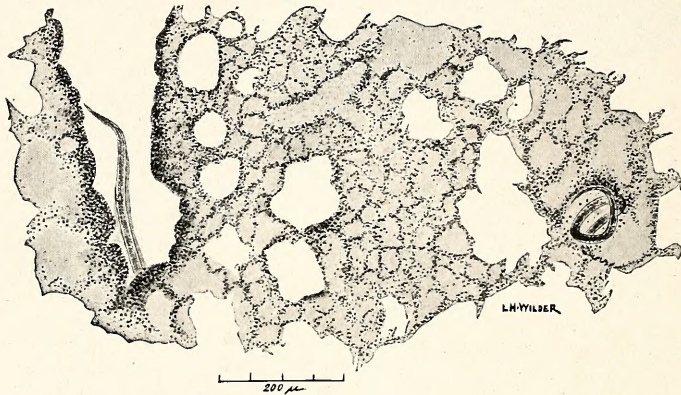


Figure 11. This shows two young hookworms in the lungs. The worm on the left is entering the air tubes. (Next, see Fig. 12.)

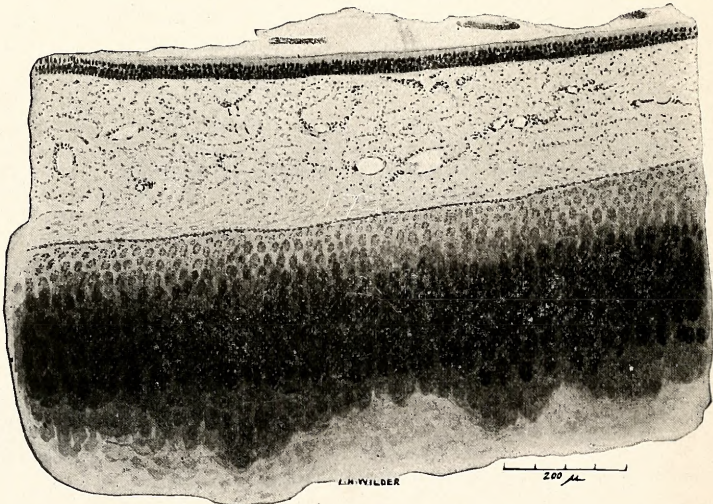


Figure 12. We now find young hookworms (see the three spots on the top of the picture) wandering up the windpipe (trachea). (Next, see Fig. 13.)

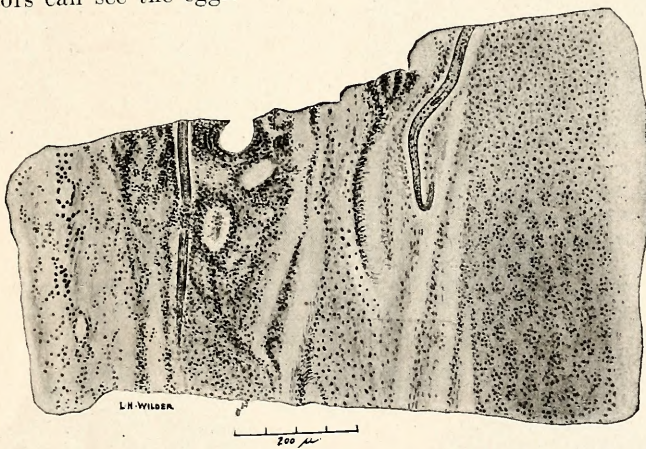
so that the doctor can be sure whether the patient has hookworms, it is necessary to give to the doctor a specimen (about



half an ounce) of the fresh passage from the bowels; this is sent by the doctor to the State Board of Health or to the State laboratory, where it is examined to see whether it contains hookworm eggs (Fig. 3). If these eggs are found, the person should be treated for hookworms.

**Question 27. Can these eggs be seen by the naked eye?**

No; they are too small to be seen by the naked eye. But when the specimen is looked at under a strong magnifying glass (called a microscope, because it aids us to see small things) the doctors can see the eggs.



**Figure 13.** Here we see two young hookworms in the larynx (Adam's apple). The worms pass to the intestine (bowels) and again take food and grow, shedding their skin two more times.

**Question 28. What is the State Board of Health?**

This is a committee of doctors paid by the State to prevent the spread of disease.

**Question 29. Is it necessary to pay for having the specimen examined by the State Board of Health?**

No; the examination is made free of charge. All you have to do is to give the specimen to your family doctor (physician) and ask him to have the examination made. He may, however, ask you to furnish a "mailing case" (which will cost about 15 to 25 cents) in which to send it, and he may ask you to pay the postage.

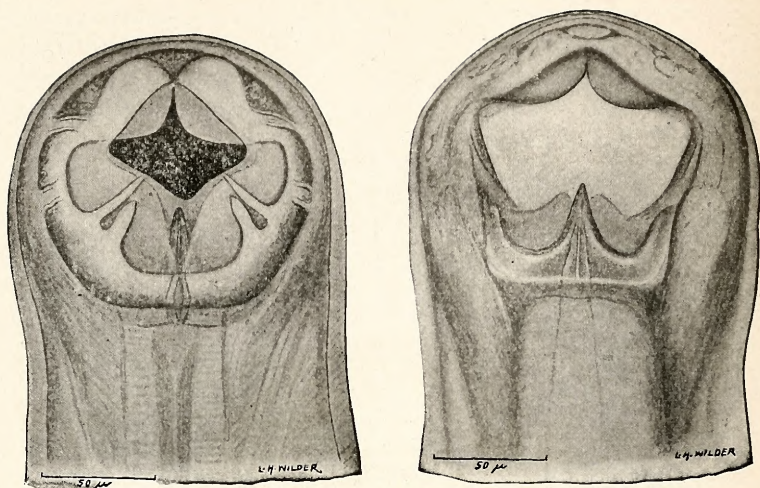


Figure 14. Head of a hookworm, greatly magnified with a microscope. We are looking directly into the mouth and see (above) the two jaws, and in the middle of the picture we see a hollow tooth, somewhat similar to the poison-fang of a snake.

Figure 15. This is the same head as shown in Figure 14, but at a deeper level. The two jaws are seen above and the fang-like tooth in the middle.

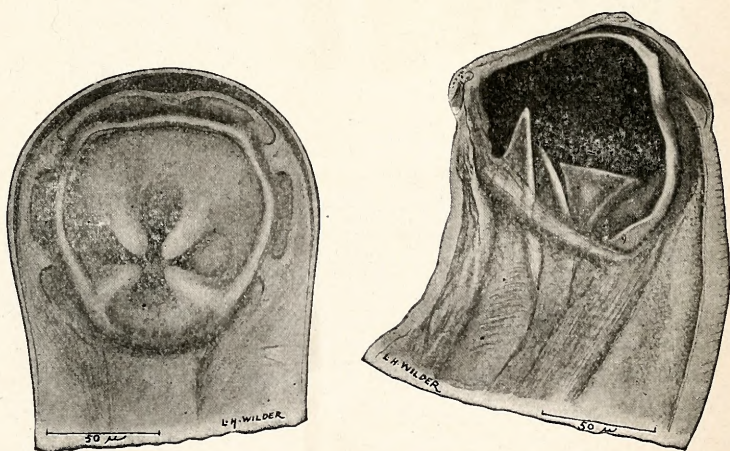


Figure 16. This figure shows the entrance into the esophagus or gullet, which is guarded by four cutting blades.

Figure 17. A side view of the head, greatly magnified and showing the mouth cavity (the very black portion), into which extend the prominent fang-like tooth and the sharp lancets.



**Question 30. Can you make a mailing case at home?**

It is best not to try to do so, as the Post-office laws are very strict. Either buy a mailing case or write to the State Board of Health to send you one.

**Question 31. What should be sent with the specimen?**

Care must be taken to write on a paper the name, age, sex, and race (white or negro) of the person from whom the specimen comes, and also the name and address of the family physician, and to send this paper (but no other writing) in the mailing case.



Figure 18. This shows the head of a hookworm as the parasite is feeding, attached to the wall of the bowels.

**Question 32. If a person has hookworms, should he try to doctor himself?**

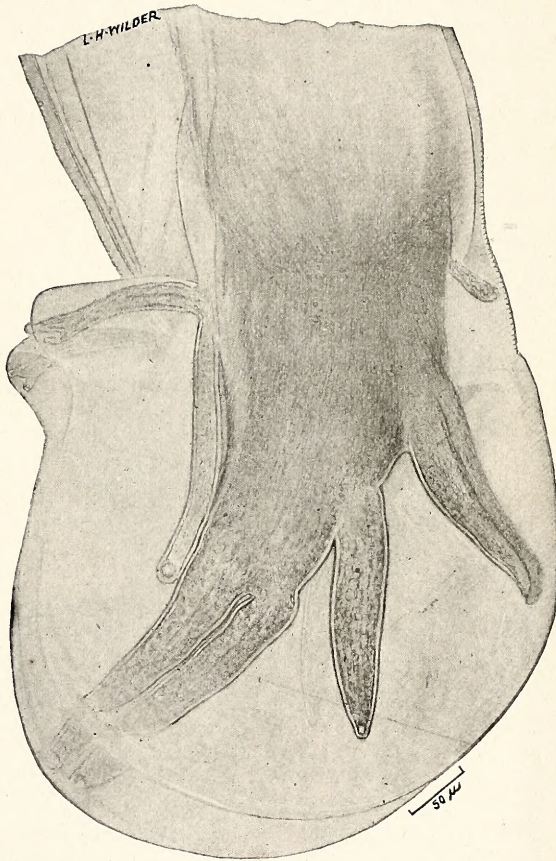
NO. He should be doctored by his family physician, as the size of the dose of medicine depends upon the patient's age and condition, and especially upon the condition of his heart.

**Question 33. Is it a good plan to take "patent" or secret medicines for hookworms?**

NO. Much harm may be done by taking secret and "patent" medicines, especially those advertised as "sure cures." It is always best to go to the family physician, who can study the patient and can decide what medicine and how much of it should be used.

**Question 34.** Suppose the family physician laughs when asked if you have hookworm disease, and tells you that there is no such sickness?—

No doctor who is fit to be our family physician will do that. If any doctor does do that, it is time for us to select another.



**Figure 19.** Side view of the umbrella-like expansion of the tail of the male hookworm, supported by muscular rays, similar to the ribs of an umbrella. The first worm ever described as belonging to the hookworm group happened to have these rays bent like hooks, and they were first thought to be hooks. This is the origin of the name "hookworm."

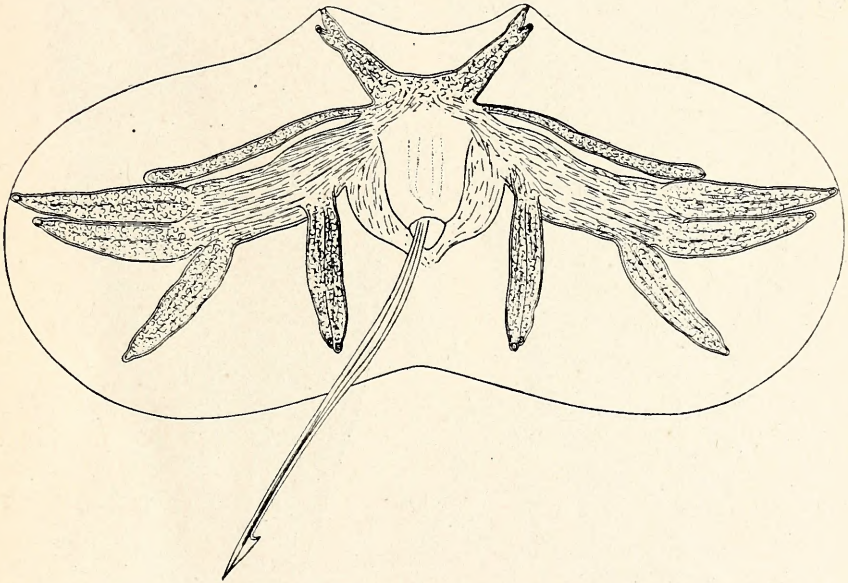
**Question 35.** For what is hookworm disease frequently mistaken?

For malaria. Many cases called "pernicious or chronic malaria" are in reality cases of hookworm disease.



**Question 36.** If hookworm disease remains untreated, what may result?

A person with severe hookworm disease may become a "dirt-eater" in case he is not treated. Many persons die as a result of the infection. Some persons remain weak and sickly for years without knowing the cause; their strength (vitality) is reduced, and if they are taken sick from some other disease, such as consumption or pneumonia, they are more liable to die than if they were not weakened by the hookworms. Some persons do not suffer any, but they may spread the disease to other people; such persons are called "carriers."



**Figure 20.** View of the umbrella-like expansion, spread out flat and showing the arrangement of the "rays."

**Question 37.** Does a person ever outgrow hookworm disease?

Yes. The worms may live certainly for six and a half years and probably for ten or twelve years. If no new infection occurs, the patient will gradually improve in condition as the worms die.

**Question 38.** How common is hookworm disease?

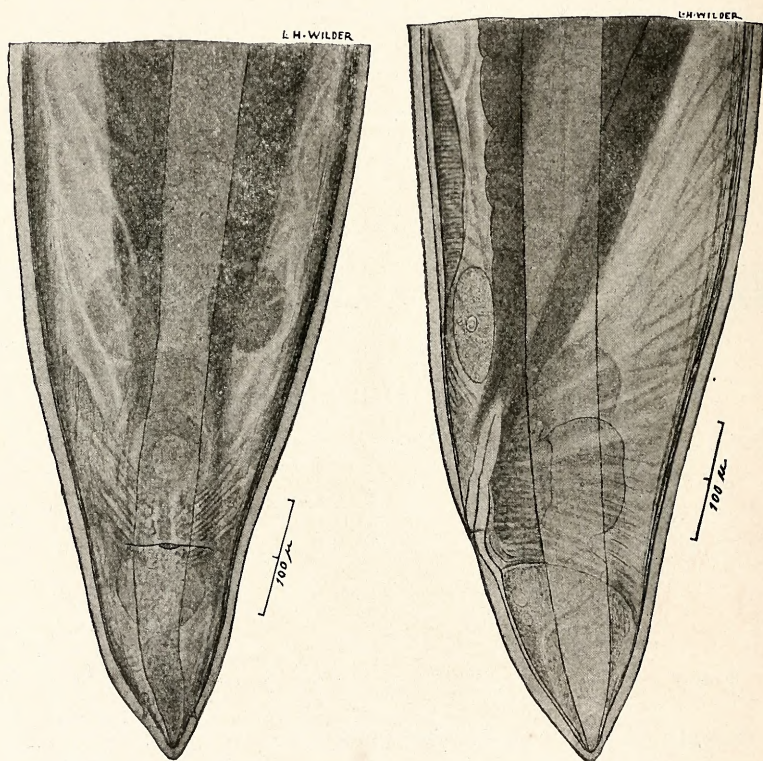
Its frequency varies in different places. In some schools five to nine pupils out of every ten have the worms. In the cotton mills probably one person out of every four is infected.

Question 39. Is the paleness of the cotton-mill people due to hookworms?

Yes, as a rule.

Question 40. What is a dirt-eater?

A dirt-eater is a person who has an unnatural appetite, and on this account eats clay, sand, plaster, soot, wood, cloth, or other things not intended for food.



Figures 21 and 22. Ventral view (Fig. 21) and side view (Fig. 22) of the tail of a female hookworm.

Question 41. Is dirt-eating the cause of hookworm disease?

It is the result of the disease, not the cause.

Question 42. Can dirt-eating be cured?

Yes, very easily; by curing hookworm disease.

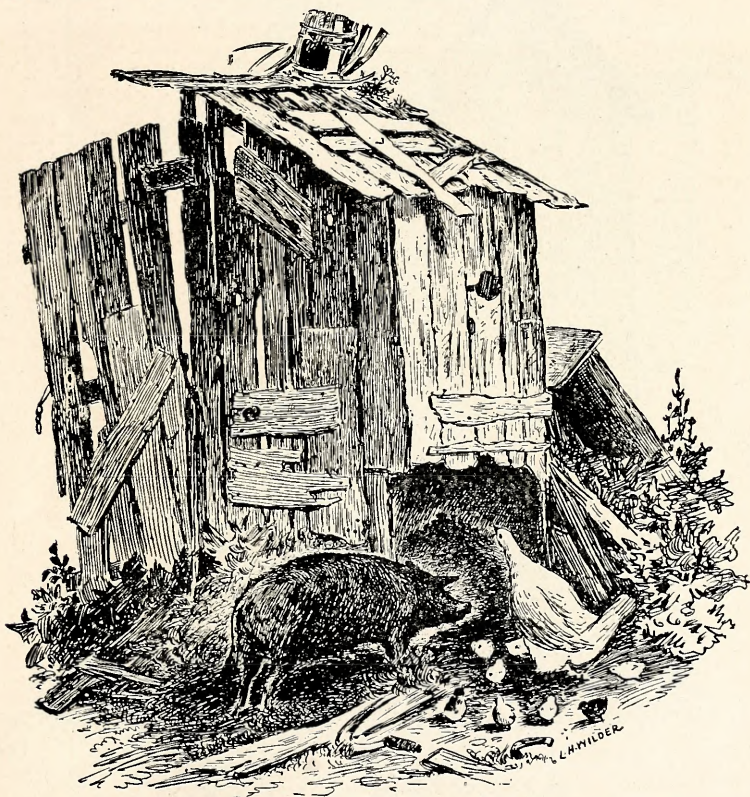


**Question 43. Can dirt-eating be prevented?**

Yes, very easily; by preventing soil pollution and thus preventing ground-itch and hookworm disease.

**Question 44. How can hookworm disease be prevented?**

By building good privies and keeping them clean. Not only should every house have a good privy or closet, but churches and schools also should be provided with them.



**Figure 23.** This is an extremely poor privy, from which soil pollution is being spread by chickens and swine. This is an altogether too frequent sight on our farms. Flies can breed in the filth and carry it, with disease germs, to the food. No farm with a privy of this kind should be permitted to sell milk.

**Question 45. Is there a privy in your yard?**

**Question 46. Is there a privy at your school?**

Question 47. Is there a privy at your church?

Question 48. How should a privy be built?

There should be a pail, or a barrel, or a tub, or a water-tight box under the seat (Fig. 25), and the privy should be closed in back so that chickens, hogs, and dogs cannot reach the discharges.

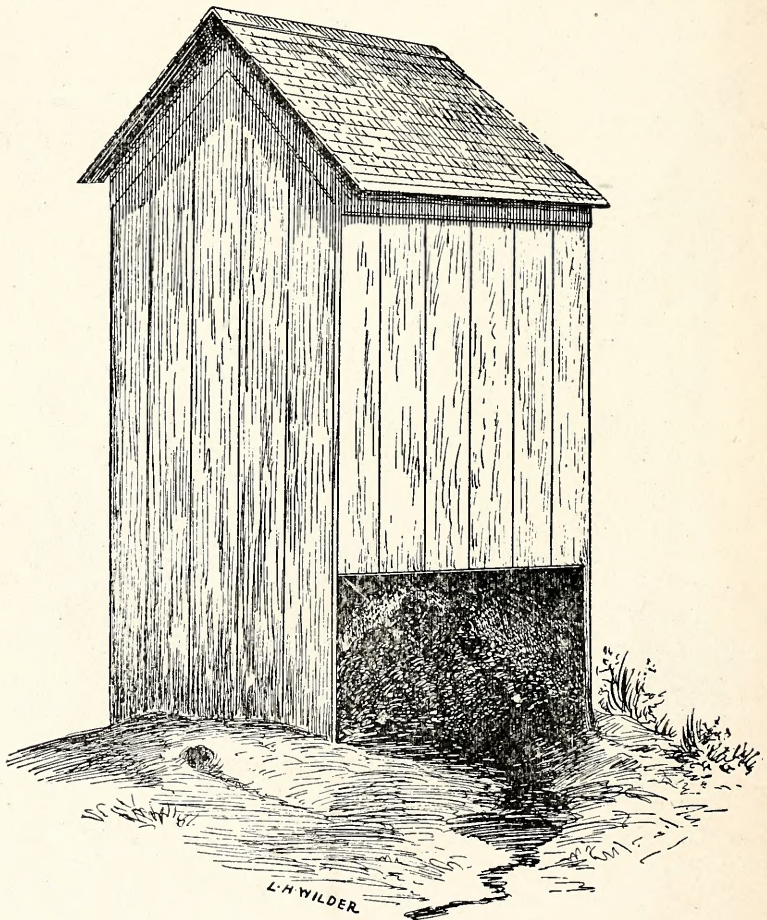


Figure 24. This is the usual style of privy found on farms and in villages. Soil pollution is spreading. Flies breed here and spread disease. Not only can hookworms spread from such a privy, but typhoid fever and other diseases may spread from it. No farm with a privy of this kind should be permitted to sell milk.



Question 49. How can flies be kept away from the tub?

By pouring some fluid known as disinfectant<sup>1</sup> into the tub.

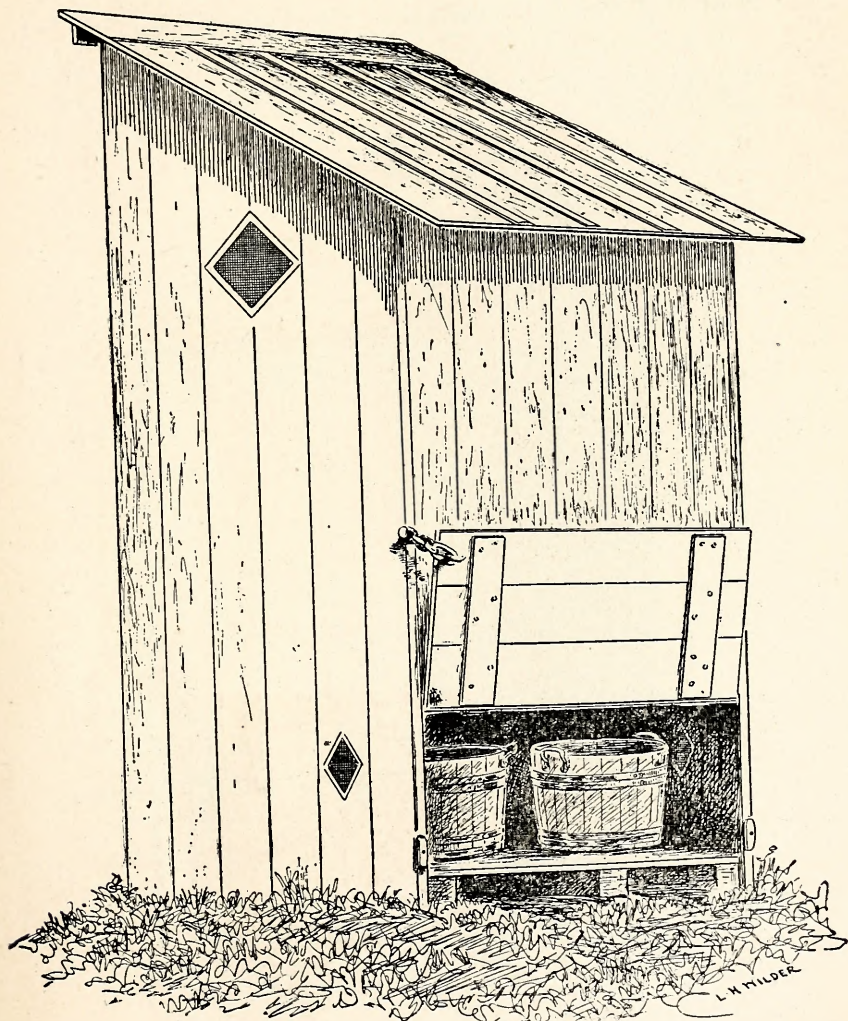


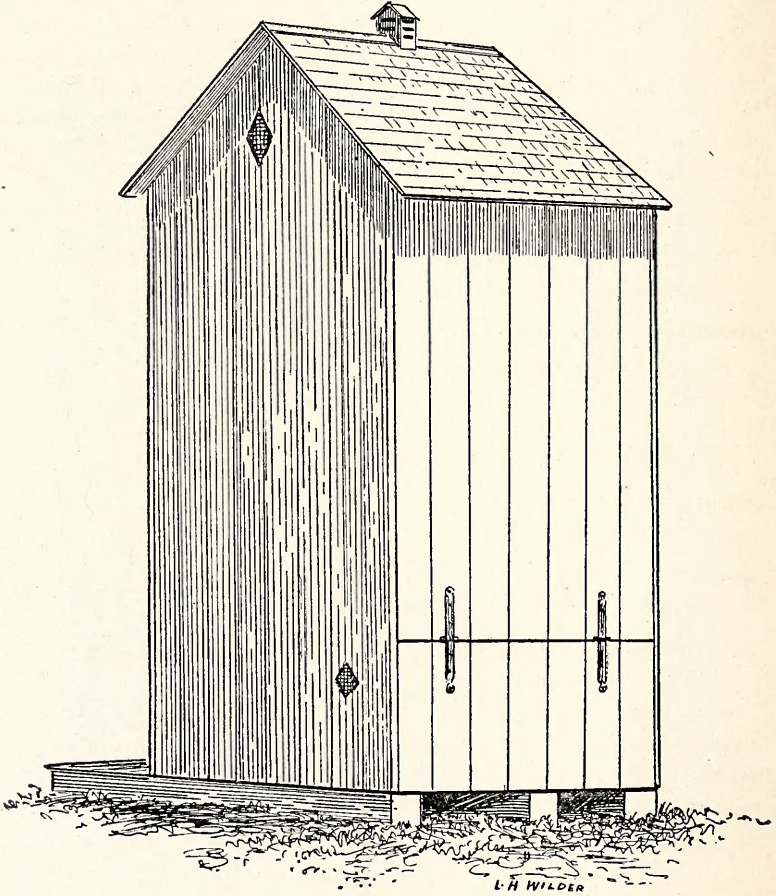
Figure 25. This shows a sanitary privy, designed to prevent the spread of disease. If a privy of this type were built on every farm and in every yard in villages, and if this privy were used by all persons, typhoid fever, hookworm disease, and various other maladies would almost or entirely disappear.

<sup>1</sup>For parents: Such as 1 part of compound solution of cresol (U. S. P.) to 19 parts of water; ordinary sheep dip also may be used.

Or some water may be placed in the tub and a cupful of crude oil<sup>2</sup> may be poured on the water.

**Question 50.** Why is it dangerous for flies to visit privies?

Because flies may go from the privy to the house and carry filth and the germs of disease to the sugar, butter, bread, meat, and other food.



**Figure 26.** A sanitary privy very similar to that shown in Figure 25.  
Let every school boy whose home is not supplied with a water-closet see that his house has a sanitary privy.

<sup>2</sup>For parents: Kerosene oil will answer the purpose.



**Question 51. Is it dangerous to use the human discharges for fertilizer?**

It is very dangerous to health to take fresh human discharges from a privy and use the material as fertilizer. Such material is very liable to spread disease. This is especially the case in warm climates.

Some villages have "septic tanks" in which the discharges are kept for a number of hours and allowed to ferment and to become fluid. But even then they may contain disease germs, and it is best not to use them as fertilizer or carelessly dispose of them unless they are disinfected. If discharges from such tanks are used as fertilizer, it is best not to put them on fields used for growing vegetables which are not cooked before being eaten—as celery, etc.

**Question 52. How often ought a privy to be cleaned?**

Once or twice a week, as a rule. Then a fresh layer of sand or dirt should be put into the pail, box, or tub.

**Question 53. What should be done with the discharges?**

They should be buried not less than two feet deep, down hill from and certainly not nearer than 300 feet to any well or spring. Or they should be burned. Or they should be put into a pit, protected against flies, and here permitted to ferment.

**Question 54. Is it safe to throw the discharges on the manure pile?**

No; that is very, very dangerous, because of the danger of spreading disease to people (especially by flies, which breed in the manure) as well as to cattle and hogs.

**Question 55. What disease may be spread to cattle and hogs from human discharges?**

If a person has certain tapeworms, and cattle or hogs eat the discharges from that person, these animals contract diseases known as "beef measles" and "hog measles." If the meat of such animals is eaten people catch tapeworms.

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